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ARRHOPALITES KRISTIANI SP. N. (COLLEMBOLA, SYMPHYPLEONA, ARRHOPALITIDAE) FROM A CAVE IN EASTERN CARPATHIANS

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Arrhopalites kristiani **sp. n. (Collembola, Symphypleona, Arrhopalitidae) from a Cave in Eastern Carpathians. Vargovich R. S.** — A new collembolan species of the genus *Arrhopalites* Börner, 1906 from Ukrainian (Eastern) Carpathians is described, figured and compared with similar species. *A. kristiani* Vargovich, sp. n. belongs to the species group with one spine on the dens but differs from the other known species by the presence of thin, elongate and untoothed claws, swollen setae on female anogenital segment and the shape of the mucro tip.

Key words: *Arrhopalites*, Collembola, new species, cave/adit, Carpathia, Ukraine.

Arrhopalites kristiani **sp. n. (Collembola, Symphypleona, Arrhopalitidae) из пещеры в Восточных Карпатах. Варгович Р. С.** — Описан новый вид ногохвосток рода *Arrhopalites* Börner, 1906 из пещеры в Украинских (Восточных) Карпатах. *A. kristiani* Vargovich, sp. n. принадлежит к группе видов с одним шипом на денс, но отличается от остальных известных видов наличием тонких удлиненных коготков без зубцов, утолщенными хетами аногенитального сегмента самки и формой апикального кончика мукро.

Ключевые слова: *Arrhopalites*, ногохвостки, новый вид, пещера/штольня, Карпаты, Украина.

Introduction

Six species of genus *Arrhopalites* Börner, 1906 were recorded from the caves of Ukrainian (Eastern) Carpathians during our biospeleological investigations (Vargovich, 2000). One of them, collected from Dovharunya cave/adit, on the left bank of the river Tisa in the Marmarosh mountains, is the second new species from the region and described here.

Head chaetotaxy is given according to the nomenclature of Christiansen (1966). Setae names of tibiotarsi, dens and partly of antennae are given following Nayrolles (1988, 1990, 1991). Nomenclature of Lawrence shown in K. Christiansen, P. Bellinger (1998) for setae of anogenital abdominal segment is used.

Arrhopalites kristiani Vargovich, **sp. n.** (fig. 1—2; tabl. 1—2)

Material examined. Holotype: female, 1 mm, slide C-289—1 — Ukraine, Zakarpatska oblast, Rakchivskyi district, near village Dilove, 4.01.1999 (leg. R. Vargovich), Dovharunya cave (type locality), 50 m from entrance, depth — 15 m, on the water surface. Paratypes on slides — from the same cave: female, 3 males, 14.02.1998; 4 males, 12.10.1998; female, 2 males, 4.01.1999.

Holotype and paratypes are preserved in the collections of the Schmalhausen Institute of Zoology (Kyiv).

Description. Female. body 0.9—1.0 mm length, with grayish pigmentation more intensive on dorsal part, with 4 pairs of trichobothria (fig. 1, *1*).

Head (fig. 1, *3*). Dorsal setae slender, 4 setae in M-row. Labral setal pattern: a: 4, m: 5, p: 5; prelabral: 6. Eyes 1 + 1, black in alcohol.

Antennae. 1.7—1.8 times as long as head diagonal. Ant. I: II: III: IV = 1 : 2 : 3.2 : 7.7—8.2. Ant. I (fig. 1, *4*) with 6 anterior and 1 small posterior setae. Ant. II (fig. 1, *4*) with 15 setae. Ant. III (fig. 1, *5*) with 18 setae; apical organ includes 2 sense rods one

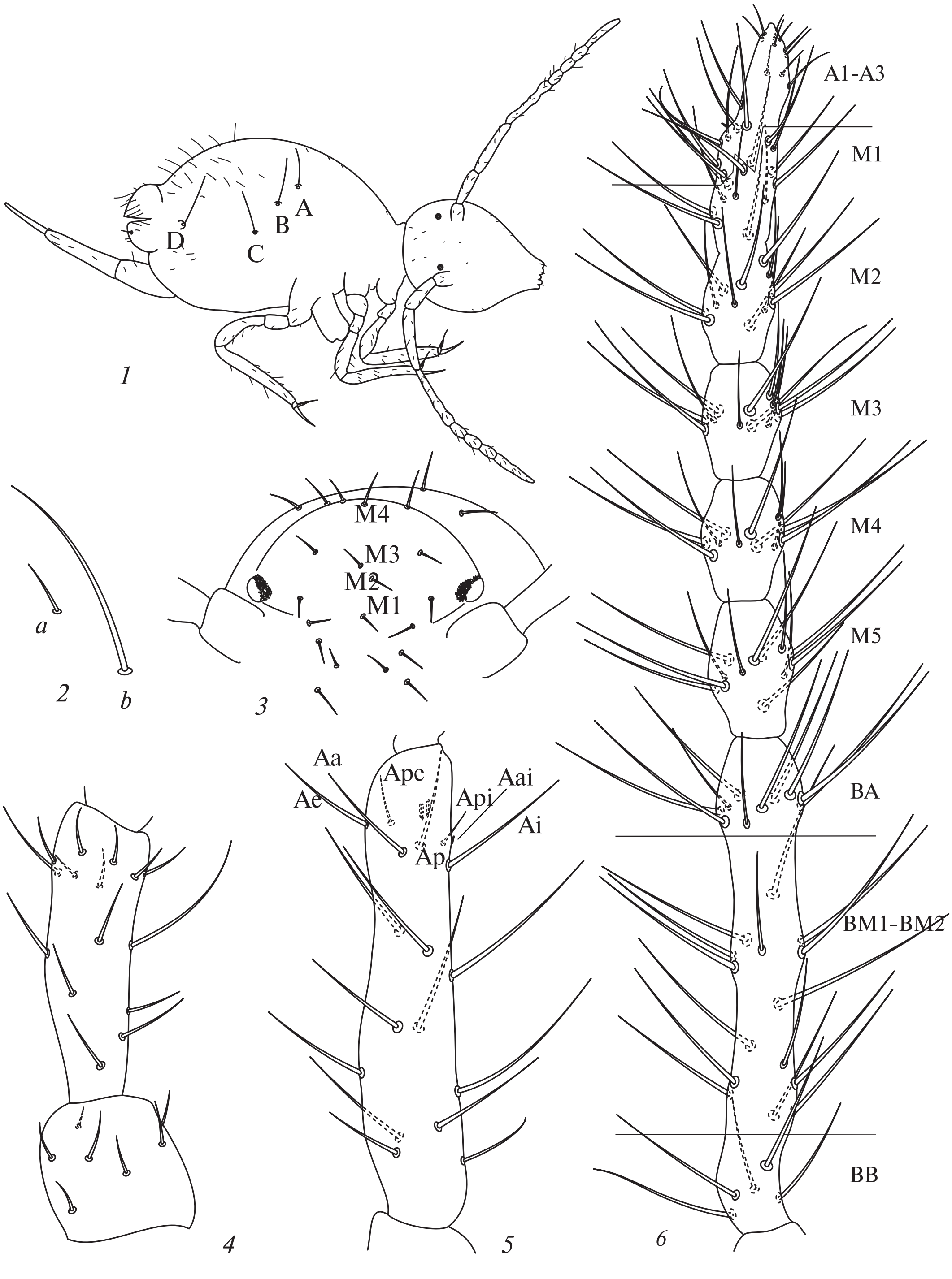


Fig. 1. *Arrhopalites kristiani: 1* — habitus and trichobothrial pattern; *2* — body setae: *a* — fore part of great abdomen, *b* — hind part; *3* — dorsal chaetotaxy of head; *4* — Ant. I—II, anterior view; *5* — Ant. III, anterior view; *6* — Ant. IV, posterior view.

Рис. 1. *Arrhopalites kristiani*: *1* — габитус и размещение трихоботрий; *2* — хеты тела: *a* — на передней части большого брюшка, *b* — на задней части; *3* — дорсальная хетотаксия головы; *4* — первый и второй членики усика, вид спереди; *5* — третий членик усика, вид спереди; *6* — четвертый членик усика, вид сзади.

of which is situated a little higher than another; setae Api and Ape shorter and thinner than Ai, Ap, Aa and Ae; seta Aai short and blunt. Ant. IV (fig. 1, *6*) distinctly subdivided into 5 subsegments. Subsegmental formula: 1 + 3 + 1 = (A + M1—M2) + (M3—M5) + (B). Ant. IV bears 12 whorls of setae: 5 on apical subsegment (AI—AIII, M1—M2), 3 on median subsegments (M3—M5) and 4 on basal subsegment (BA, BM1, BM2, BB). Basal subsegment of Ant. IV subequal with Ant. III and 1.4 times as long as apical subsegment of Ant. IV.

Foreleg. Coxa (fig. 2, *1*) with 1 posterior seta. Trochanter (fig. 2, *1*) with 4 setae. Femur (fig. 2, *1*) with 11 setae, one of which in the middle part of segment turned perpendicularly to the longitudinal axis of the segment. Tibiotarsus (fig. 2, *4*) with 3 setae FP (FPe, FPae, Fppe) and seta FSa; 9 setae in whorl I; 8 setae in each of whorls II-V. Pretarsus with 1 anterior and 1 posterior setulae. Fore claw (fig. 2, *4*) long, thin, without tooth and tunica. Empodium (fig. 2, *4*) narrow, without corner tooth and with apical filament almost reaching tip of claw. Claw 3.1—3.2 times shorter than tibiotarsus.

Mid leg. Coxa (fig. 2, *2*) with 3 setae. Trochanter (fig. 2, *2*) with anterior trochanteral organ and 3 simple setae. Femur (fig. 2, *2*) with 13 setae. Tibiotarsus (fig. 2, *5*): whorls I-IV as in foreleg, whorl V with 7 setae (Va seta missing). Claw (fig. 2, *5*) similar to fore claw. Empodium (fig. 2, *5*) in basal half broader than in foreleg; empodial filament slightly not reaching tip of claw. Claw 3.0—3.1 times shorter than tibiotarsus.

Hind leg. Coxa (fig. 2, *3*) with 4 setae. Trochanter (fig. 2, *3*) with anterior trochanteral organ, 2 anterior and 1 posterior simple setae. Femur (fig. 2, *3*) with 12 setae. Tibiotarsal chaetotaxy similar to mid leg (fig. 2, *6*). Claw (fig. 2, *6*) as in fore and mid leg. Empodium (fig. 2, *6*) broad, with tiny up to absence corner tooth. Claw 3.5—3.7 times shorter than tibiotarsus.

Lengths ratio of tibiotarsi I : II : III = 1 : 1 : 1.2.

Great abdomen. Dorsal setae simple, short on fore half and long (subequal to hind claw) on hind half (fig. 1, *2*). Trichobothria placed as in figure 1, *1*.

Ventral tube with 1 + 1 subapical setulae.

Tenaculum (fig. 2, *8*). Ramus 3-dentate, with basal appendage; anterior lobe with 2 or 1 apical setulae; tip of posterior lobe reaching tip of anterior lobe.

Furca (fig. 2, *9*). 1.9—2.1 times shorter than body. Manubrium (fig. 2, *9*) with 6 + 6 posterior setae. Posterior and anterior chaetotaxy of dens as in figure 2, *9* and table 1: only one spine present (Ie); setae Ipe, IIpe, Ii, IIIpi and IVpi thicker than others in their basis; 3, 2, 1... 1 setae on anterior side. Dens 1.6 times as long as mucro. Mucro (fig. 2, *9*) with serrated edges; tip is narrowed and inclinated.

Anogenital abdominal segment: chaetotaxy as in fig. 2, *11*. Setae of C-series broad in subbasal half. C2—C3 (C4) setae serrated on broadened edges. Setae A1 and C1 unpaired. Subanal appendage inserted in comma-shaped papilla, rod-like with apical denticulation (fig. 2, *7*, *11*).

Table 1. Dens chaetotaxy of *Arrhopalites kristiani*
Таблица 1. Хетотаксия денс *Arrhopalites kristiani*

Generatrices		e	ae	a	ai	i	pi	p	pe
whorls I—V	I	S	+	+	+	s	—	+	s
	II	—	+	+	—	—	—	+	s
	III	—	—	+	—	—	s (—)	+	+
	IV	—	—	— (+)	—	—	s (—)	+	+ (—)
	V	—	—	+	—	—	—	—	+ (—)
whorl B		—	—	—	—	—	+	+	+

S — spine; s — weakly spine-like setae; in brackets — variable aberrations.

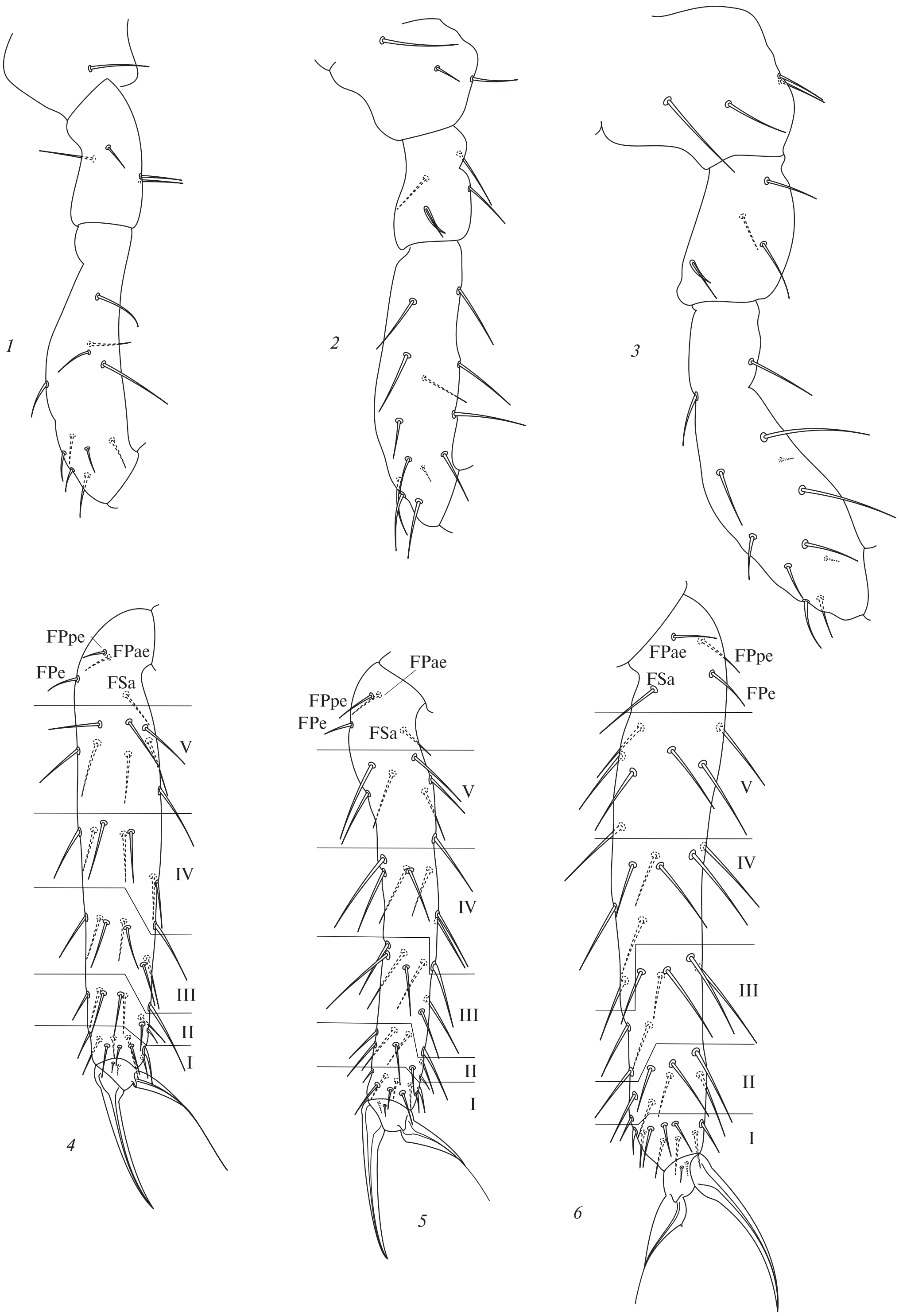


Fig. 2. *Arrhopalites kristiani*: *1* — fore leg, posterior view: coxa, trochanter, femur; *2* — mid leg, anterior view: coxa, trochanter, femur; *3* — hind leg, anterior view: coxa, trochanter, femur; *4* — foreleg, posterior view: tibiotarsus, foot complex; *5* — mid leg, posterior view: tibiotarsus, foot complex; *6* — hind leg, anterior view: tibiotarsus, foot complex; *7* — female subanal appendage; *8* — tenaculum; *9* — furca, posterior view; *10* — anogenital abdominal segment of male, lateral view; *11* — anogenital abdominal segment of female, lateral view.

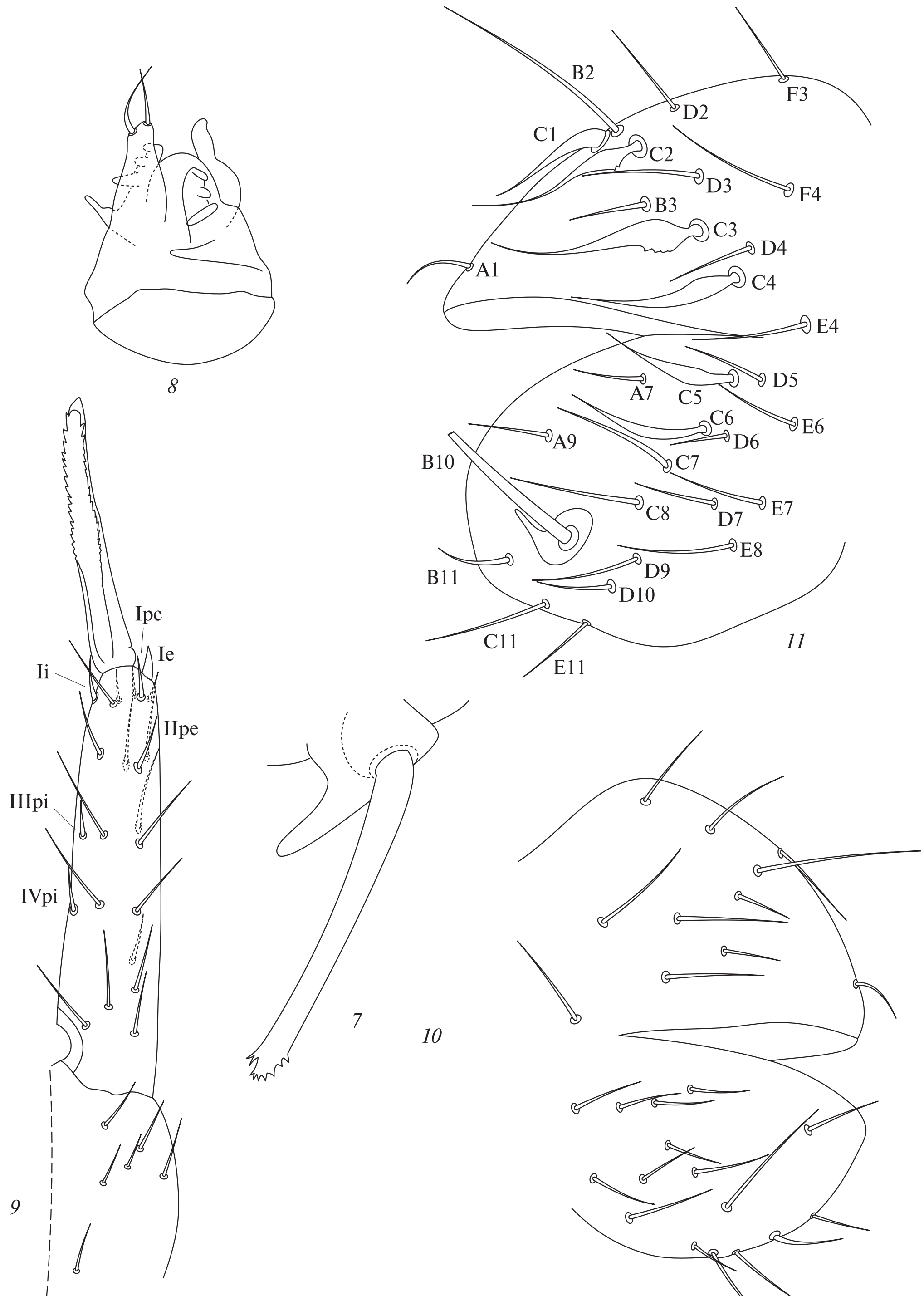


Рис. 2. *Arrhopalites kristiani*: *1* – тазик, вертлуг и бедро передней ноги, вид сзади; *2* – то же средней ноги, вид спереди; *3* – то же задней ноги, вид спереди; *4* – тибиотарсус и дистальный комплекс (коготок и эмподий) передней ноги, вид сзади; *5* – то же средней ноги, вид сзади; *6* – то же задней ноги, вид спереди; *7* – субанальный придаток самки; *8* – зацепка; *9* – прыгательная вилка, вид сзади; *10* – аногенитальный сегмент брюшка самца, вид сбоку; *11* – то же самки.

Male. Maximum body length 0.85 mm. Head relatively shorter than in female. Antennae 1.8—1.9 times as long as head diagonal. Ant. IV with with 5 subsegments, or with 6 subsegments in case of separation of BA setal whorl. Chaetotaxy of anogenital abdominal segment (fig. 2, *10*) differs from such in female by lesser number of setae and by shape of C-setae, not broadened in male.

Variability. Lengths proportions of antennal segments I : II : III : IV = 1 : 1.8—2.2 : 2.7—3.2 : 7.1—8.3. Number of setae on whorls of Ant. IV may slightly vary. Empodia of fore and mid leg sometimes with corner inclination looking like indistinct corner tooth. Empodium of hind leg with a very small up to absence corner tooth. Number of tenaculum apical setulae (2 or 1) apparently varies even inside the same micropopulation. Some specimens show incomplete posterior dens chaetotaxy (variable setae marked in brackets in tabl. 1). In single case female dens with 3, 2, 1, 1, 1 anterior setae − an example, when important diagnostic feature shows variability. In one case seta C4 of female anogenital segment is forked.

Differential diagnosis. *Arrhopalites kristiani* sp. n. belongs to the assembling of species with combination of characters: (1) presence of single spine on dens and (2) absence of basal swelling on Ant. III. Twelve taxa with such condition were described: *A. boneti* Stach, 1945, *A. subboneti* Cassagnau & Delamare, 1953, *A. giovannensis* Cassagnau & Delamare, 1953, *A. cochlearifer dudichi* Loksa & Rubio, 1966 and *A. aggtelekiensis buekkensis* Loksa, 1969 from Europe; *A. clarus* Christiansen, 1966, *A. sacer* Christiansen & Bellinger, 1996, *A. ater* Christiansen & Bellinger, 1998, *A. sapo* Zeppelini & Christiansen, 2003 and *A. sextus* Zeppelini & Christiansen, 2003 from North America; *A. gul* Yosii, 1966 from Korea and *A. uenoi* Yosii, 1956 from Japan. Such combination as presence of: elongated, thin and untoothed claws of legs + untoothed empodia of fore and mid leg + strongly swollen C-setae of female anogenital segment + presence of 5 subsegments on Ant. IV + narrowed tip of mucro distinctly separates *A. kristiani* sp. n. from all mentioned species (tabl. 2).

Bionomy. 11 specimens were collected from lower level of cave/adit (natural and anthropogenic genesis) from the pool surface. This part of cave is stopped by stony gorge and cold draught is present in winter: so connection with surface is possible. Only

Table 2. Some differences between *Arrhopalites kristiani* and similar species
Таблица 2. Некоторые различия между *Arrhopalites kristiani* и похожими видами

Species	Antenna: head	Subsegments of Ant. IV	Claws inner tooth I; II; III	Empodial corner tooth I; II; III	Swollen setae on female Abd. VI	Spiny setae on head	Tip of mucro
A. kristiani sp. n.	1.65—1.92	5 (6)	− − −	− − +	+ (strongly)	−	narrowed
A. boneti	2.25	6	+ + +	− − −	−	?	broadened
A. subboneti	?	6	− + +	+ + +	−	?	broadened
A. giovannensis	?	6	+ + +	+ + −	+	−	narrowed
A. cochlearifer dudichi	?	6	− − −	+ + +	?	+	rounded
A. aggtelekiensis buekkensis	2.25	8 (9; 10)	+ + +	+ + −	−	−	broadened
A. clarus	?	7 (6; 5)	+ (−) + +	+ + +	+ (slightly)	+	broadened
A. sacer	2.0	7	− + +	+ + + (−)	+ (slightly)	−	rounded
A. ater	1.5−2.0	5	+ + +	+ + + (−)	+	−	broadened
A. sapo	1.97−2.15	5	+ + +	+ + −	+	−	broadened
A. sextus	2.5−3.2	7	+ + +	+ + +	−	−	rounded
A. gul	2.9	7	− (+) − −	− − −	+	+	broadened
A. uenoi	4.0	15	− − −	− + −	−	−	broadened

one specimen was found on upper level of cave together with *A. bifidus* Stach, 1945, far away from real and possible entrances. It may be a troglophilous species.

Etymology. This species I dedicate to my son Kristian.

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Christiansen K. The genus Arrhopalites in the United States and Canada // Int. J. Speleol. — 1966. — **2.** — P. 43—73.

Christiansen K., Bellinger P. The Collembola of North America North of The Rio Grande, Revised Edition. Grinnell College, Grinnell, 1998. — P. 1—1518.

Nayrolles P. Chétotaxie tibiotarsale des Collemboles Symphypléones // Trav. Lab. Ecobiol. Arthr. Edaph. — 1988. — **5** (4). — P. 1—19.

Nayrolles P. Chétotaxie furcale des Collemboles Symphypléones // Trav. Lab. Ecobiol. Arthr. Edaph. — 1990. — **6** (2). — P. 27—50.

Nayrolles P. La chétotaxie antennaire des Collemboles Symphypléones // Trav. Lab. Ecobiol. Arthr. Edaph. — 1991. — **6** (3). — P. 1—94.

Vargovich R. Arrhopalites (Collembola) from the caves and adits of Transcarpathia (West Ukraine) // Fauna jaskýň (Cave Fauna) / Eds A. Mock, L'. Kováč, M. Fulin. — Košice, 2000. — P. 175—184.